



## **Economic Impact Analysis Virginia Department of Planning and Budget**

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### **4 VAC 5-15 – Nutrient Management Training and Certification Regulations**

#### **Department of Conservation and Recreation**

March 30, 2005

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The Department of Planning and Budget (DPB) has analyzed the economic impact of this proposed regulation in accordance with Section 2.2-4007.G of the Administrative Process Act and Executive Order Number 21 (02). Section 2.2-4007.G requires that such economic impact analyses include, but need not be limited to, the projected number of businesses or other entities to whom the regulation would apply, the identity of any localities and types of businesses or other entities particularly affected, the projected number of persons and employment positions to be affected, the projected costs to affected businesses or entities to implement or comply with the regulation, and the impact on the use and value of private property. The analysis presented below represents DPB's best estimate of these economic impacts.

### **Summary of the Proposed Regulation**

§10.1-104.2 of the Code of Virginia requires that the Department of Conservation and Recreation (DCR) operate a voluntary nutrient management training and certification program to certify the competence of persons preparing nutrient management plans (NMP) for the purpose of assisting land owners and operators in the management of land application of fertilizers, municipal sewage sludge, animal manures, and other nutrient sources for agronomic benefits and for the protection of the Commonwealth's ground and surface waters. Specifically, the code requires DCR to promulgate regulations detailing qualifications and standards by which to deem individuals competent in NMP preparation and providing criteria relating to the development of NMPs for various agricultural and urban agronomic practices. In addition, Chapter 1 of the 1999 Acts of Assembly amended §62.1-44.17:1.1 of the Code of Virginia to require that DCR, in consultation with the Department of Environmental Quality (DEQ), complete an examination of current developments in scientific research and technology (including a review of land

application of poultry waste, soil nutrient retention capacity, and water quality degradation) and adopt and implement appropriate regulatory or other changes, if any, to its NMP program by December 31, 2005.

The proposed regulation (1) modifies phosphorous and nitrogen management criteria for NMPs, (2) expands training requirements for individuals seeking certification and individuals seeking to renew their certification as a nutrient management planner, and (3) amends NMP content and procedures in areas other than phosphorus and nitrogen management.

The proposed regulation also provides additional options to satisfy the education and experience requirements for certification or renewal of certification as a nutrient management planner, modifies record keeping and reporting requirements for certified nutrient management planners, expands conditions under which certification may be denied, suspended, or revoked, requires nutrient management planners to sign all NMPs prepared by them, restricts NMPs for croplands to a maximum of three years, updates documents incorporated by reference, and specifies the conditions under which NMPs need to be modified immediately. However, none of these changes are expected to have a significant economic impact.

The proposed regulation also adds new language, modifies existing language, and deletes redundant language for the sake of clarity. Other changes such as requiring NMPs for industrial wastes containing nutrients and requiring soil analyses included in NMPs to be conducted by DCR-approved laboratories are intended to make the regulation consistent with current practice and with the code of Virginia.

## **Estimated Economic Impact**

NMPs are prepared to manage the land application of fertilizers, sewage sludge or biosolids, manure, and other nutrient sources for agronomic benefits. Nutrients contained in these compounds have the potential to contaminate surface and ground waters through leaching, surface runoffs and soil erosion. Nutrient contamination of surface and ground waters, in turn, has the potential to create serious environmental and health hazards. While the proposed regulation establishes NMP requirements, it does not require the use of NMPs. NMPs are required under other regulations, such as permit regulations governing certain types of animal waste and animal feeding operations and the land application of biosolids and industrial waste. Comparison of the various sources of land applied organic nutrients in Virginia by DCR

indicates that poultry manure supplies the largest proportion of phosphorus and nitrogen for land application, followed by biosolids, dairy manure, and swine manure.

*Significant Changes:*

(1) The proposed regulation modifies *phosphorus* management criteria for NMPs. It requires phosphorus application rates to be managed such that adverse water quality impacts are minimized. The existing regulation only recommends that phosphorus application rates be managed to reduce adverse water quality impacts and describes planning considerations that help achieve this recommendation. Specifically, the proposed regulation requires phosphorus application rates from inorganic nutrient sources and, whenever possible, from organic nutrient sources to be based on a soil test and be such that it does not exceed crop nutrient needs over the crop rotation. In instances when it is not possible for phosphorus applications from organic nutrient sources to meet the above requirement, phosphorus control practices contained in the NMP are to be consistent with management provisions contained in the Virginia Nutrient Management Standards and Criteria, 2005. However, under no circumstances are phosphorus applications to be conducted on soils exceeding phosphorus saturation levels specified the Virginia Nutrient Management Standards and Criteria (2005): 65% for plans developed between December 31, 2005 and December 31, 2010 and 50% after 2010.<sup>1</sup> A single phosphorus application can be recommended for multiple crops as long as the application rate does not exceed the sum of the individual application rates. Due to the more stringent requirements for phosphorus-based nutrient management planning, the proposed regulation amends and clarifies the soil sampling depths for phosphorus soil analysis.<sup>2</sup>

The proposed regulation also modifies *nitrogen* management criteria for NMPs. The timing requirements for nitrogen applications are made more stringent. Both the existing and proposed regulations allow application of nitrogen containing materials to sites with an actively growing crop or to sites where a crop will be established within 30 days of the nutrient

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<sup>1</sup> The Virginia Nutrient Management Standards and Criteria (2005) provides the nutrient management planner with several methods by which to determine appropriate rates of phosphorus application: the soil test method, the environmental threshold method, and the phosphorus index method. According to DCR, the soil test method is the most stringent in terms of phosphorus application rates, but the least expensive for nutrient management planners to use. The phosphorus index method is the least stringent in terms of phosphorus application rates, but the most expensive for nutrient management planners to use.

<sup>2</sup> The soil sampling depths are modified from 2"-4" to 0"-4" for untilled fields and from 6"-8" to 0"-6" for tilled fields.

application. However, the proposed regulation places more restrictions on winter application (between December 21 and March 16) of organic nutrient sources containing nitrogen than the existing regulation. The existing regulation allows winter application under certain circumstances. The proposed regulation only allows such applications a maximum of 30 days prior to crop planting for high-risk sites and 60 days prior to crop planting for low-risk sites. Low-risk sites are defined as sites that are not deemed environmentally sensitive site and that have at least 60% uniform ground cover from an existing actively growing crop. Application of composted nutrient sources having a final carbon to nitrogen ratio of 25:1 or greater are exempt from these requirements.

The proposed regulation also makes a number of other small changes to the nitrogen management criteria. Specifically, it amends how expected crop yield used to determine nitrogen applications are to be calculated (the proposed change is in response to a 2005 Joint Legislative Audit and Review Commission report<sup>3</sup>) and how nitrogen contribution from legumes is to be credited in an NMP. However, according to DCR, neither of these changes is likely to significantly alter current practice.

*Economic Costs:* The proposed phosphorus and nitrogen management criteria are likely to impose additional costs on the users and suppliers of nutrients containing phosphorus and nitrogen.

According to DCR, manure and biosolids are the primary source of excess *phosphorus*.<sup>4</sup> Land application of these two sources of nutrients has resulted in phosphorus far in excess of what is required for crop farming purposes. Lower phosphorus application rates implied by the new phosphorus management criteria could result in farmers having to (i) use commercial fertilizers to supplement their reduced use of manure and biosolids, (ii) lease or purchase additional land for application to substitute for fields with excessive phosphorus or high runoff and soil erosion characteristics, (iii) transport manure and biosolids to more distant fields for application, and (iv) incur additional costs in the development of NMPs.

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<sup>3</sup> “Review of Nutrient Management Planning in Virginia”, House Document No. 20, Report of the Joint Legislative Audit and Review Commission to the General Assembly of Virginia, 2005.

<sup>4</sup> Unlike manure and biosolids, commercial fertilizer can be formulated to match crop needs.

In the case of manure users and suppliers, DCR believes that the proposed change could affect hog and dairy farmers and some poultry farmers.<sup>5</sup> According to DCR, the hog industry is located primarily in southeast Virginia and the southern piedmont. The farms in southeast Virginia are individually owned and most are likely to be able to balance phosphorus generated in manure with crop utilization. The southern piedmont farms entered the hog business only in the mid-1990s and have generally not reached soil phosphorus levels that would require applications to be restricted. However, some corporate hog farms will need to pursue additional land or install other technology to reduce phosphorus applications. Most dairy farms are expected to control sufficient land area to utilize phosphorus in dairy manure. According to DCR, they are already applying dairy manure at crop removal rates and supplementing nitrogen requirements from other sources. However, they may have to haul manure to more distant fields for land application. Poultry farmers are currently allowed to apply phosphorus at crop removal rates. After October 31, 2005<sup>6</sup>, some poultry farmers will be able to apply phosphorus at rates higher than currently allowed. On the other hand, some sites may have to reduce their application of phosphorus. For example, if the phosphorus index procedure for a field indicates 65% or greater phosphorus saturation or if the phosphorus index value is 100 or greater, no phosphorus can be applied to those soils. While the overall impact on poultry farmers is hard to determine with any degree of certainty, DCR expects that more fields will be able to receive higher application rates of phosphorus than fields receiving lower application rates compared to current requirements.

For biosolids users and suppliers, the new phosphorus management criteria are not expected to affect overall application rates. Existing biosolids application sites that exceed phosphorus saturation levels specified in the Virginia Nutrient Management Standards and Criteria (2005) will no longer be able to receive land applications. In such instances, new land application sites will have to be found and permitted. As existing permitted land is excluded because of higher phosphorus soil test levels, it will have to be replaced with new land application sites with lower phosphorus saturation levels. Overall, DCR does not expect significant additional acreage being used for the land application of biosolids as a result of the new phosphorus management criteria. However, some farmers currently using biosolids to meet

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<sup>5</sup> Crop farmers are likely to be unaffected by the proposed phosphorus management criteria as they tend to use commercial fertilizer over manure or biosolids.

their crop nitrogen needs will no longer be able to do so due to high soil phosphorus saturation levels. Instead, they will have to incur additional costs in supplementing nitrogen from other sources. Others will be able to reduce their need for supplemental nitrogen through the land application of biosolids. Overall, the additional cost to some farmers is likely to be balanced by the cost savings to others. Currently, NMPs are not required for the land application of biosolids. However, the Virginia Department of Health (VDH) is in the process of promulgating regulations that would require NMPs for all such sites. All discussion of costs and benefits of the new phosphorus management criteria relating to biosolids applications are contingent on these regulations eventually being adopted.

(i) DCR estimates that the cost to hog farmers of supplementing nitrogen through the increased use of commercial fertilizers or other nitrogen sources could range from no additional cost to \$13 per acre.<sup>7</sup> Any costs associated with supplementing nitrogen would be an additional cost to hog farmers as manure is generally available to them at no cost.<sup>8</sup> (ii) In addition, DCR estimates that more land area may be necessary to utilize excess manure and biosolids. For hog farmers, the agency estimates that 20% more land may be required. There are currently 66 hog operations requiring NMPs, with an average of 176.2 acres receiving manure applications. A 20% increase implies that an additional 35.2 acres would be needed to apply the excess manure. According to DCR, the cost of leasing additional land for application of manure varies between \$25 and \$50 per acre. In the case of biosolids applicators, they will be required to find additional land for application in order to substitute for existing land application sites with high phosphorus levels. Thus, biosolids applicators will incur additional costs associated with finding new application sites that meet the requirements of this regulation and with obtaining a biosolids land application permit from VDH for the new sites. An estimate of the acreage that will no longer be available for land application of biosolids following the implementation of this regulation is not possible at this time. (iii) Farmers may also incur additional transportation costs associated with moving the manure to more distant fields for application. These costs could be significant due to the bulk and consistency of manure and biosolids. For example, the cost of transporting low-

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<sup>6</sup> Effective date of a new law requiring that poultry applications conform to the requirements of this regulation.

<sup>7</sup> Hog farmers tend to use manure, not biosolids, to meet crop nitrogen requirements.

<sup>8</sup> Dairy and swine manures are generally applied on the farms where they are produced. Poultry litter may be used on the farm where it is produced or may be sold to other farmers. The price of poultry litter ranges from \$0 to \$25 per ton.

density manure more than short distances from the site of its production sometimes exceeds its nutrient value. (iv) Finally, the proposed phosphorus management criteria could make the preparation of NMPs more complex. DCR estimates that it could cost up to an additional \$8 per acre to prepare an NMP meeting these requirements: \$8 per acre if the phosphorus index method is used and less than \$1 per acre for the two other methods.<sup>9</sup>

As discussed above, in the case of poultry farmers, the new phosphorus management criteria are likely to provide cost savings. According to DCR, the acreage not able to receive poultry manure due to high phosphorus saturation rates is likely to be small compared to the total acreage receiving poultry manure and more than offset by acreage now able to receive higher rates of poultry manure application. Thus, overall, poultry farmers are likely to reap cost savings through a reduced need for commercial fertilizers and other supplemental nitrogen sources, a reduced need for additional land for utilizing excess phosphorus, and potentially lower transportation costs associated with moving the manure to distant fields for application. Due to the uncertainty surrounding the number of poultry farmers likely to benefit and lose out due to the proposed change, an estimate of the cost savings is not possible at this time.

Users and suppliers of manure and biosolids will also be required to meet more stringent timing requirements for the land application of nutrients containing *nitrogen*. DCR does not believe that the more stringent requirements will affect overall nitrogen application rates. However, the proposed timing requirements are likely to require users and suppliers of biosolids to curtail their activities during the winter months. According to DCR, the proposed change is not likely to have a significant impact on current practice relating to the use of manure and commercial fertilizers containing nitrogen. While a fair amount of land application of biosolids does occur during the winter months, the same is not true of regulated manure operations. Unlike biosolids, manure applications have been NMP-based for some time, with little or no winter application. As overall application rates are not likely to be affected by the new requirements, the proposed restrictions on winter application of nutrients containing nitrogen is not likely to have a significant effect on users and suppliers of commercial fertilizers.

Restrictions on winter applications of biosolids will require users and suppliers to store the material during the winter months or plant fall seeded cover crops at winter land application

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<sup>9</sup> DCR estimates that it currently costs between \$3.50 and \$6 per acre to develop an NMP.

sites. The storage options include landfilling the material and constructing storage facilities. According to DCR, it costs between \$30 and \$50 per wet ton to landfill biosolids (a high cost option). VDH estimates that construction of storage facilities, mainly temporary storage facilities, meeting the requirements of its proposed regulations costs approximately \$500 per hundred tons of stored material. Planting fall seeded cover crops on winter application sites is an alternative to placing the material in storage. The cost of planting such a crop is estimated at approximately \$25 per acre.

In addition to the costs discussed above, implementation of the proposed regulation is likely to impose additional costs on DCR, especially with respect to the new phosphorus management criteria. The new requirements are likely to require development of additional training materials and examination questions, increased training for DCR staff, and added state oversight and enforcement. The agency estimates a one-time cost of \$50,000 to reprogram software used by planners to develop NMPs and an annual cost of \$20,000 to administer the program.

*Economic Benefits:* The proposed regulation is likely to produce significant environmental and health benefits. Phosphorus and nitrogen contamination of surface and ground water can result in environmental and health hazards.

The environmental hazards arise from the accelerated eutrophication – an increase in the rate of supply of nutrients – of surface water. Eutrophication produces a number of negative environmental consequences that restrict the use of these waters for aesthetics, fisheries, recreation, and industry. These include oxygen depletion (hypoxia), increased turbidity, loss of submerged vegetation, and alteration of food webs. Experiments have shown that either phosphorus or nitrogen may be the limiting nutrient for eutrophication, with phosphorus being the more limiting nutrient in waters with lower salinity and nitrogen being the more limiting nutrient in waters with higher salinity.<sup>10</sup> Moreover, due to the easier identification and control of point sources in recent years, non-point sources of phosphorus and nitrogen in agricultural runoff are contributing an increasing proportion of nutrient input. In Virginia, the DEQ estimates that, based on 2002 conditions, approximately 66% of the nitrogen and 76% of phosphorus entering

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<sup>10</sup> Boesch, D. F., R. B. Brinsfield, and R. E. Magnien, 2001. Chesapeake Bay Eutrophication: Scientific Understanding, Ecosystem Restoration, and Challenges for Agriculture. *Journal of Environmental Quality* 30: 303-20.

the Chesapeake bay and its tidal tributaries from Virginia can be attributed to non-point sources. Boesch et al. (2001) also estimate that agriculture is the single largest source of nitrogen and phosphorus entering the Chesapeake Bay.

Land application of manure and biosolids has resulted in phosphorus far in excess of what is required for farming. According to Sharpley et al. (1994)<sup>11</sup>, 58% of soil samples in Virginia in 1989 tested high for phosphorus. One of the main reasons for the high phosphorus levels is that nutrient application rates are generally nitrogen-based, i.e., based on soil nitrogen content and crop nitrogen requirements. As manure and biosolids tend to have lower nitrogen to phosphorus ratios than taken up by crops, use of both has resulted in phosphorus levels in excess of that required for farming.

Phosphorus loss due to soil erosion and runoff can be reduced by basing applications not just on crop nitrogen requirements and by restricting phosphorus applications on saturated soils. Sharpley et al. (1994) conclude that it is of vital importance that management practices are implemented that minimize phosphorus build up in excess of crop requirements, utilize alternative phosphorus sources and residual soil phosphorus levels, and improve methods to identify soils capable of enriching bio-available phosphorus loss in runoff. The changes to phosphorus application rates being proposed are likely to reduce the actual load of phosphorus entering ground and surface waters.

Winter applications of nutrients containing nitrogen has a high risk of resulting in nitrogen being discharged into surface waters through soil erosion, runoffs, and leaching into ground water. However, the major flow path for nitrogen losses is leaching into ground water during winter recharge. Ground water recharge and nitrate leaching for most regions occur mainly in the fall and winter months when crop uptake and evaporation is at its minimum. A study by Weil et al. (1990)<sup>12</sup> examined the leaching of nitrogen from fall applications of poultry manure. Four fields in Maryland's coastal plain were studied: two receiving only fertilizer nitrogen and two receiving poultry manure applications. The study found that nitrate concentration in ground water under the poultry-manured fields was significantly higher between

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<sup>11</sup> Sharpley, A. N., S. C. Chapra, R. Wedepohl, J. T. Sims, T. C. Daniel, and K. R. Reddy, 1994. Managing Agricultural Phosphorus for Protection of Surface Waters: Issues and Options. *Journal of Environmental Quality* 23:437-451.

<sup>12</sup> Weil, R. R., Weismiller, R. A., and R. S. Turner, 1990. Nitrate Contamination of Groundwater Under Irrigated Coastal Plain Soils. *Journal of Environmental Quality* 19: 441-48.

December and March than under fertilizer-only fields. Moreover, results of the study indicated a short residence time for these ground waters, as little residual nitrates from the previous years' manuring was evident. A study by Evanylo (2003)<sup>13</sup> looked at the effects of biosolids application timing and soil texture on the availability of nitrogen for corn. The study was based on field experiments conducted on coarse- and fine-textured soils from two farms in the coastal plains of Virginia between 1996 and 1998. The study concluded that, due to winter weather variability, the opportunities for mineralization of nitrogen from winter-applied anaerobically digested biosolids and subsequent transport into ground water can be high in the coastal plains of Virginia.

Nitrogen loss through leaching and runoff can be reduced by placing restrictions on winter applications and by the use of fall and winter cover crops. A study conducted by Staver and Brinsfield (1998)<sup>14</sup> concluded that applying organic nitrogen sources in early fall can result in dramatic increases in nitrate leaching losses during the following winter and that cereal grain winter cover crops were effective in reducing nitrate leaching rates. Thus, the proposed changes to nitrogen application timing are likely to reduce the actual load of nitrogen entering ground and surface waters.

In addition to the environmental effects discussed above, the proposed changes are likely to produce health benefits. Excessive nutrient levels in surface and ground water used for drinking can be harmful to human health. For example, drinking water containing over ten parts per million of nitrate-nitrogen is believed to cause methemoglobinemia<sup>15</sup> in infants. Pregnant women, adults with reduced stomach acidity, and people deficient in certain types of enzymes are also susceptible to nitrite-induced methemoglobinemia. Thus, reducing the amount of nitrogen entering drinking water sources is likely to produce health benefits for the state.

Virginia is committed to reducing nutrient and sediment levels in the Chesapeake Bay as part of the 2000 Chesapeake Bay agreement and the 2000 six-state memorandum of understanding with the Environmental Protection Agency (EPA). In May 1999, EPA placed most of Virginia's portion of the Chesapeake Bay and several of its tidal tributaries on the

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<sup>13</sup> Evanylo, G. K., 2003. Effects of Biosolids Application Timing and Soil Texture on Nitrogen Availability for Corn. *Communications in Soil, Science, and Plant Analysis* 14: 125-143.

<sup>14</sup> Staver, K. W., and R. B. Brinsfield, 1998. *Crop Management Systems for Reduction of Hydrologic Nutrient Transport*. Final report submitted to Maryland Department of Agriculture and funded by Governor's Council on Chesapeake Bay Research.

<sup>15</sup> A lack of oxygen transport to the brain.

impaired waters list. The 2000 Chesapeake Bay agreement<sup>16</sup> set a goal of removing these waters from the list of impaired water bodies for nutrients and sediments by 2010. The changes to the phosphorus and nitrogen criteria in the proposed regulations are necessary to bring the effectiveness of NMPs to the level assumed in the Chesapeake Bay model used to develop Virginia's tributary strategies<sup>17</sup>. The Chesapeake Bay model used in the tributary strategies to track progress in meeting phosphorus and nitrogen reductions and to project nutrient reductions assumes that phosphorus application rates and nitrogen application timing are being optimized.

Reductions in the phosphorus application rate and restrictions on winter applications of nutrients containing nitrogen are likely to reduce the risk of runoff of phosphorus and nitrogen to surface waters and leaching of these nutrients into ground water. Existing literature indicates that there are significant environmental benefits from reducing nutrient discharge into surface waters, including benefits to public health, commercial fisheries, tourism and recreation, property values in surrounding areas, and the regional economy in general. Refer to the economic impact analysis of proposed regulations 9 VAC 25-40 (Policy for Nutrient Enriched Waters) and 9 VAC 25-720 (Water Quality Management Planning Regulation) for a detailed discussion of the environmental benefits accruing from surface water quality improvements in general and from reducing phosphorus and nitrogen loading in Chesapeake Bay and its tidal tributaries in specific.<sup>18</sup> Any estimate of the benefits is subject to great uncertainty and such estimates in existing literature cover a wide range of values. However, despite covering a wide range of values, estimates of the benefits of reducing nutrient discharge into surface waters are generally significant. For example, recreational use benefits for the Chesapeake Bay area as a whole from a 40% reduction in nitrogen and phosphorus concentrations is estimated to be in the millions of dollars.<sup>19</sup> A 60% improvement in water quality is estimated to have provided annual

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<sup>16</sup> The signatories to the 2000 Chesapeake Bay agreement were Pennsylvania, Maryland, Virginia, Washington, D.C., the Chesapeake Bay Commission, and EPA. However, in a separate six-state memorandum of understanding with EPA, New York, Delaware, and West Virginia also made the same commitment.

<sup>17</sup> Chesapeake Bay Nutrient and Sediment Reduction Tributary Strategy for the Eastern Shore, James River, Lynnhaven, and Poquoson Coastal Basins, Shenandoah and Potomac River Basins, Rappahannock River and Northern Neck Coastal Basins, and York River and Lower York Coastal Basins.

<sup>18</sup> The economic impact analysis is published in the Virginia Register of Regulations, Volume 2, Issue 12 (February 21, 2005).

<sup>19</sup> Krupnick, A., 1988. Reducing Bay Nutrients: An Economic Perspective. *Maryland Law Review* 47(2): 453-480.

recreation use benefits to people living in Washington, D.C., Virginia, and portions of Maryland ranging from the millions to the billions of dollars.<sup>20</sup>

The net economic impact of the new phosphorus and nitrogen management criteria will depend on the relative magnitude of the costs and benefits associated with the proposed changes. Precise estimates of the costs and benefits are not possible at this time. Cost estimates are subject to uncertainty as identification of affected entities and the additional costs/cost savings accruing to these entities cannot be estimated with any reasonable degree of confidence. For example, the tributary strategies estimate the cost of implementing agricultural best management practices in Chesapeake Bay and its tidal tributaries, but these costs are not related specifically to changes in the proposed regulations. Similarly, a precise estimate of the benefits is also not possible at this time. For example, the tributary strategies specify the percentage of total nitrogen and phosphorus loading into the Chesapeake Bay and its tidal tributaries attributable to agriculture. However, the amount of the reductions in these nutrients resulting from the new phosphorus and nitrogen management practices is not known. Thus, given the many large uncertainties, it is not possible at this time to make a sound determination of the net economic impact of the proposed change. However, both the costs and benefits are likely to be large and the net economic impact, whether positive or negative, is not likely to be very large.

(2) The proposed regulation expands training requirements for individuals seeking initial certification or seeking to renew their certification. Applicants for initial certification will now be required to take examinations that address phosphorus nutrient management planning methods and assessment techniques and timing of nitrogen applications. DCR anticipates approximately six hours of additional training. Applicants are expected to incur additional costs of \$30 each in obtaining the required training. DCR receives approximately 46 first-time applications for certification each year (based on the average number of applicants in 2002, 2003, and 2004). Thus, the additional requirements would cost applicants a total of \$1,380 per year.<sup>21</sup> Renewal requirements for individuals certified prior to the effective date of the proposed regulation have also been expanded to include additional training in phosphorus nutrient management planning methods and assessment techniques. DCR anticipates between four to six

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<sup>20</sup> Morgan, C. and N. Owens, 2001. Benefits of Water Quality Policies: The Chesapeake Bay. *Ecological Economics* 39: 271-284.

<sup>21</sup> Assuming that all applicants decide to take the additional training prior to appearing for the examination.

hours of additional training. The cost to participants includes a \$20-\$25 registration fee. According to DCR, there are currently 290 certified nutrient management planners operating in the state. Thus, the additional requirements would impose a one-time cost of between \$5,800 and \$7,250 on individuals certified prior to the effective date of this regulation. In addition to the cost of the training itself, the proposed change is also likely to impose some additional economic costs. The time taken to meet the training requirements must be valued as time that would have otherwise been used for productive activities. Thus, the proposed change will result in lost income for the applicant during the time they are in training. Hourly wages for a certified nutrient management planner range from \$10 to over \$19. Finally, the proposed change is also likely to impose some travel-related costs, including costs related to traveling to and from the training center and the cost of any overnight stays.

The expanded training requirements are also likely to impose additional costs on DCR. For initial certification training, teaching costs are estimated at approximately \$164 per hour or \$984 for six hours. DCR is also likely to incur costs associated with providing materials and handouts, renting a facility in which to hold the training, and copying and postage. Currently, DCR incurs approximately \$2,700 in material costs, \$1,650 in facility costs, and \$175 in copying and postage costs for a four-day training session (24 hours of training) for 28 individuals. Based on these costs, an additional six hours of training will cost approximately \$1,131. Finally, DCR is expected to incur costs in terms of staff time devoted to developing presentations and teaching aids. Based on the amount of staff time spent on the four-day training session, the proposed change will require 46 additional hours of DCR staff time. At an average of \$34 an hour, it would cost DCR an additional \$1,564 to provide the additional training. DCR offers initial certification training twice a year. Thus, the increase in initial training requirements will cost the agency over \$7,000 a year. DCR estimates that the additional training required for renewal of certification will cost the agency \$580 in facility rental and other costs. In addition, it will require 45 hours of staff time. Thus, this change will impose a one-time cost of \$2,110 on the agency.

The net economic impact of the proposed change will depend on whether the costs of additional training are greater than or less than the benefits accruing from it. By ensuring that individuals certified as nutrient management planners are able to implement the requirements of the regulation, the proposed regulation will reduce the risk of phosphorus and nitrogen loss to

surface and ground waters. As discussed in the previous section, reducing phosphorus and nitrogen loss to surface and ground waters will, in turn, produce significant environmental and health benefits for the state. The net economic impact of the proposed change will depend on the relative magnitude of these benefits. While a precise estimate of the benefits is not possible at this time, the net economic impact of the proposed change, whether positive or negative, is not likely to be very large.

(3) The proposed regulation expands the plan content of NMPs in areas other than phosphorus and nitrogen management. It adds several elements to the list of features that must be indicated on aerial maps contained in NMPs. While some of these elements relate to the new phosphorus management criteria, the remaining are based on recommendations of the 2005 Joint Legislative Audit and Review Commission (JLARC) report. The report recommends that NMPs be consistent with statutory requirements and include a site map indicating the location of waste storage facilities and fields where waste is to be applied. In addition, the report recommends that site maps identify environmentally sensitive sites and buffer areas in the acreage to be managed. The additional detail on site maps recommended by the JLARC report will add planning time for on-site investigations and map production. DCR estimates that the proposed change could increase planning costs by approximately \$1 per acre.

The proposed regulation also makes a number of other changes to NMP content and procedures. It requires NMPs to include potassium soil analysis results and potassium application rates consistent with recommendation contained in the Virginia Nutrient Management Standards and Criteria (2005). However, this requirement is not likely to impose significant additional costs as laboratories currently report this information when conducting phosphorus soil analysis. It requires NMPs to include lime recommendations to adjust soil pH to an agronomic level appropriate for existing or planned crops. DCR does not believe that this requirement will have a significant effect on current practice, as there have been very few instances of soil pH rising to above the appropriate agronomic level. It tightens application requirements for secondary nutrients and micronutrients<sup>22</sup> and modifies organic nutrient source

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<sup>22</sup> Secondary nutrients (such as sodium, calcium, and magnesium) and micronutrients (such as zinc) are essential for plant life, but are required in much smaller quantities than primary nutrients such as phosphorus, nitrogen, and potassium.

analysis requirements for NMPs. However, DCR does not believe that these changes will impose significant additional costs.

The additional costs associated with these changes should be balanced with the potential benefits accruing from them. These requirements are intended to ensure that agricultural practices are conducted in a manner that is protective of the environment and of public health. By tightening the nutrient application and reporting requirements to be included in NMPs, the proposed regulation reduces the risk of nutrient loss from agricultural operations. The net economic impact of the proposed changes will depend on the relative magnitude of the costs and benefits associated with these changes. The only significant additional cost appears to be from the extra detail required on site maps. These costs are likely to be counterbalanced by the benefits to the environment and public health of better management of agricultural operations and better enforcement of existing rules and regulations. Due to the uncertainty associated with any benefits estimate, it is not possible to determine the extent to which the additional costs will be counterbalanced by the additional benefits. However, the net economic impact of the proposed change, whether positive or negative, is not likely to be very large.

*Other Changes:*

The proposed regulation makes a number of other changes. However, these changes are not likely to have significant economic impact.

- The proposed regulation provides additional options to satisfy the education and experience requirements for certification or renewal of certification as a nutrient management planner, including allowing continuing education units obtained in Delaware to be counted towards continuing education requirements required to renew certification. To the extent that these options increase flexibility for individuals seeking to be certified or seeking to renew certification without having a detrimental effect on the environment or public health, the proposed changes are likely to produce some small economic benefits.
- The proposed regulation modifies record keeping and reporting requirements for certified nutrient management planners and conditions under which certification may be denied, suspended, or revoked. To the extent that these changes improve implementation and enforcement of existing laws and regulations, they are likely to produce some small economic benefits.

- The proposed regulation requires all nutrient management planners to sign NMPs prepared by them. According to DCR, the proposed change is necessary for additional accountability and to deal with problems encountered when computer files specific to a plan have been shared by two or more certified planners. To the extent that the proposed change improves implementation and enforcement of existing laws and regulations, they are likely to produce some small economic benefits.
- The proposed regulation restricts NMPs for croplands to a maximum of three years. Existing regulations state that NMPs for cropland should not exceed three years. DCR is currently required to approve NMPs for animal waste permits and has been limiting the life of these NMPs to three years or less. The agency believes that most cropland NMPs are presently three years or less.
- The proposed regulation updates documents incorporated by reference. For example, reference to the Virginia Nutrient Management Standards and Criteria is updated to the 2005 version. According to DCR, apart from changes that reflect the new nitrogen and phosphorus criteria, the 2005 version contains technical updates to the version referenced in the existing regulation. None of the new and updated references are expected to have a significant economic impact.
- The proposed regulation specifies the conditions under which NMPs need to be modified immediately. According to DCR, the proposed change is intended to highlight serious situations needing immediate attention, such as when additional imported manure, biosolids, or industrial waste that was not identified in an existing NMP is to be applied. None of these changes are expected to have a significant impact. However, to the extent that they allow for pressing problems to be dealt with in an expedient manner, they could produce some economic benefits.

The remaining changes are even more minor in nature. New language is added, existing language is modified, and redundant language is deleted for the sake of clarity. Other changes such as requiring NMPs for industrial wastes containing nutrients and requiring soil analyses included in NMPs to be conducted by DCR-approved laboratories are intended to make the regulation consistent with current practice and with the code of Virginia.

## **Businesses and Entities Affected**

The proposed regulation affects the users and suppliers of manure and biosolids. According to DCR, there currently are 1,260 dairy, beef, swine, and poultry farmers regulated under State Water Control Board permits. In addition, there are nine sewage sludge applicators, 35 sewage treatment plants land applying biosolids, and 30 land applicators of industrial waste.

The proposed regulation also affects individuals certified or seeking to be certified as nutrient management planners. According to DCR, there currently are 290 certified planners operating in the state. In addition, the agency receives approximately 46 new applications for certification per year (based on the average for 2002, 2003, and 2004).

## **Localities Particularly Affected**

The proposed regulation applies to all localities in the Commonwealth. However, localities generating biosolids for land application are likely to be more affected than others. According to DCR, there currently are 35 sewage treatment plants in the state that land-apply biosolids. These localities are likely to incur additional costs in acquiring supplementary land for application, storing the material, or planting fall seeded cover crops. DCR estimates that, in total, it will cost these localities approximately \$500,000 per year in meeting the new phosphorus and nitrogen management criteria.

However, the additional cost to some localities is likely to be counterbalanced by the additional benefits to other localities. Localities where biosolids land application sites are located will reap environmental and health benefits from the more stringent requirements. In Virginia, 200,000 dry tons of biosolids were land applied on 42,000 acres of land in 2002.

## **Projected Impact on Employment**

The proposed regulation could affect employment in some parts of the farming industry. Apart from the costs associated with meeting the new NMP requirements, the cost associated with the additional training requirements for nutrient management planners is also likely to be passed on to farmers in the form of increased NMP preparation costs. Overall, the increased costs to farmers and land applicators could reduce profitability in the farming-related sector, potentially reducing the number of people employed in this sector.

On the other hand, the proposed regulation could have a beneficial effect on employment in industries such as commercial fisheries, tourism and recreation, and boat building and repairs that are likely to benefit from improvements in water quality. Related support and value-added industries are, in turn, also likely to reap benefits and this could have a beneficial effect on employment in these industries.

### **Effects on the Use and Value of Private Property**

The proposed regulations are likely to impose additional costs on some farming-related businesses and entities. These businesses are likely to incur additional costs in meeting the requirements of this regulation. This, in turn, is likely to increase operating costs and lower the asset value of these businesses.

On the other hand, the proposed regulations are likely to have a positive effect on businesses involved in industries such as commercial fisheries, tourism and recreation, and boat building and repairs that are likely to benefit from improvements in water quality. Improved water quality is likely to increase revenues and raise the asset value of these businesses. In addition, improvements in water quality and any subsequent increase in economic activity in surrounding areas could also have a positive impact on related support and value-added industries and on property values in the area.